MAGNETIC TELEGRAPH.

LETTER

FROM

THE SECRETARY OF THE TREASURY,

TRANSMITTING

A letter from Professor Morse, relative to the magnetic telegraph.

DECEMBER 23, 1844.
Read, and laid upon the table.

TREASURY DEPARTMENT,
December 17, 1844.

SIR: In compliance with the request made in your letter of this date, in behalf of the Committee on Commerce of the House of Representatives, for information from this department upon the subject of "Morse's telegraph," I have the honor respectfully to transmit herewith a communication from Professor Morse, dated the 12th instant, containing specific information in regard to that work.

I have the honor to be, very respectfully, your obedient servant,

GEO. M. BIBB,
Secretary of the Treasury.

Hon. ISAAC E. HOLMES,
Chairman of Committee on Commerce,
House of Representatives.

WASHINGTON, *December* 12, 1844.

SIR: I have the honor respectfully to submit some facts in relation to the ELECTRO-MAGNETIC TELEGRAPH, bearing upon the bill now before Congress, reported from the Committee on Commerce of the House, for the extension of the telegraphic line from Baltimore to New York.

By a reference to documents in the records of the government, it will appear that the subject of establishing a system of telegraphs for the use of the United States has been occasionally, for many years, before Congress; but nothing effective was ever done in relation to the matter, until the Hon. Levi Woodbury, while Secretary of the Treasury, by addressing circular letters to various individuals in the United States, (among which was one

to me,) drew forth from me a general description of the advantages of a system of electro magnetic telegraphs which I had invented in 1832, on my passage from France to the United States. For my answer to this circular letter, see appendix A, taken from House report No. 753, 25th Congress 2d session; and I refer to it now, to show that the assertions respecting the practicability and utility of my system have been fully and satisfactorily sustained by the result of the experimental essay authorized by the government, establishing the line between Washington and Baltimore.

That which seemed to many chimerical at the time, is now completely realized. The most sceptical are convinced; and the daily and hourly operations of the telegraph in transmitting information of any kind are so publicly known, and the public feeling in regard to it so universally expressed, that I need here only give a few instances of its action, further to illustrate its character.

The facts in relation to the transmission of the proceedings of the democratic convention at Baltimore in May last are well known, and are alluded to in my report to the department, June 3d, 1844. [House Doc. No. 270, 28th Congress 1st session.] Since the adjournment of Congress in June last, and during the summer and autumn, the telegraph has been in constant readiness for operation, and there has been time to test many points in relation to it, which needed experience to settle.

For more now than *eight months*, the conductors for the telegraph, carried on elevated posts for 40 miles, have remained undisturbed from the wantonness or evil disposition of any one. Not a single instance of the kind has occurred. In several instances, indeed, the communication has been interrupted by accidents, but then only for a very brief period. One of these was by the great fire in Pratt street, Baltimore, which destroyed one of the posts, and consequently temporarily stopped the communication; but in two or three hours the damage was repaired, and the first notice of the accident and all the particulars were transmitted to Washington by the telegraph itself.

Another instance of interruption was occasioned by the felling of a tree, which accidently fell across the wires, and at the same time across the railroad track, stopping the cars for a short time, and the telegraphic communications for two hours.

Excepting the time excluded by these, and two or three other similar accidental interruptions, and which, during seven months of its effective existence between the two cities, does not altogether amount to more than 24 hours, the telegraph has been either in operation, or prepared for operation, at any hour of the day or night, irrespective of the state of the weather.

It has transmitted intelligence of great importance. During the troubles in Philadelphia the last summer, sealed despatches were sent by express from the mayor of Philadelphia to the President of the United States. On the arrival of the express at Baltimore, the purport of the despatches transpired; and while the express train was in preparation for Washington, the intelligence was sent to Washington by telegraph, accompanied by an order from the president of the railroad company to prevent the Washington burden train from leaving until the express should arrive. The order was given and complied with. The express had a clear track, and the President and the Cabinet (being in council) had notice both of the fact that an express was on its way with important despatches to them, and also of the nature of those despatches, so that, when the express arrived, the answer was in readiness for the messenger.

In October, a deserter from the U. S. ship Pennsylvania, lying at Norfolk, who had defrauded also the purser of the ship of some $600 or $700, was supposed to have gone to Baltimore. The purser called at the telegraph office in Washington, stated his case, and wished to give notice in Baltimore, at the same time offering a reward for the apprehension of the culprit. The name and description of the offender's person, with the offer of the reward, were sent to Baltimore, and in ten minutes the warrant was in the hands of the officers of justice for his arrest; and in half an hour from the time that the purser preferred his request at Washington, it was announced from Baltimore by the telegraph, "The deserter is arrested; he is in jail; what shall be done with him?"

To show the variety of the operations of the telegraph, a game of drafts, and several games of chess, have been played between the cities of Baltimore and Washington, with the same ease as if the players were seated at the same table. To illustrate the independence of the telegraph of the weather, and time of day, I would state that, during the severe storm of the 5th December, when the night was intensely dark, the rain descending in torrents, and the wind blowing a gale, it seemed more than ordinarily mysterious to see a company around a table, in a warm, retired chamber, on such a night, in Washington, playing a game of chess with another company similarly situated in Baltimore; the darkness, the rain, and the wind, being no impediment to instantaneous communication.

In regard to the quantity of intelligence which may be sent in a given time, it is perfectly safe to say that thirty characters can be transmitted in a minute by a single instrument; and as these characters are conventional signs, they may mean either *numbers*, *letters*, *words*, or *sentences*. As an illustration of this point, I will state that nearly a whole column (more than seven-eighths) in the Baltimore Patriot was transmitted in thirty minutes—faster than the reporter in Baltimore could transcribe.

This fact bears upon the ability of producing a revenue from the telegraph; and I would suggest the propriety of permission being granted by Congress to the department, to adjust a tariff of charges on intelligence sent by telegraph, at such a rate of postage as shall at least return to the treasury the interest of the capital expended in the first construction, and the after maintenance of the telegraph.

In aid of this view of the subject, I beg to submit an extract from my letter to the chairman of the Committee on Commerce, December 6, 1842.—(House report No. 17, 27th Congress 3d session.)

"As a source of *revenue* to the government, few, I believe, have seriously computed the great profits to be derived from such a system of telegraphs as I propose; and yet there are sure data already obtained by which they can be demonstrated.

"The first fact is, that every minute of the 24 hours is available to send intelligence.

"The second fact is, that 12 signs, at least, can be sent in a minute, instantaneously, as any one may have proof by actual demonstration of the fact on the instrument now operating in the capitol.

"There can be no doubt that the cases, where such speedy transmission of intelligence from one distant city to another is desirable, are so numerous, that when once the line is made for such transmission, it will be in constant use, and a demand made for a greater number of lines.

"The paramount convenience, to commercial agents and others, of thus corresponding at a distance, will authorize *a rate of postage proportionate to the distance*, on the principle of rating postage by the mails.

"To illustrate the operation of the telegraph in increasing the revenue, let us suppose that but 18 hours of the 24 are efficiently used for the actual purposes of revenue; that 6 hours are allowed for repetitions and other purposes—which is a large allowance. This would give, upon a single circuit, 12,960 signs per day, upon which a rate of postage is to be charged. Intelligence of great extent may be comprised in a few signs. Suppose the following commercial communication is to be transmitted from New York to New Orleans:

"Yrs. Dec. 21 rec. Buy 25 bales c., at 9, and 300 pork, at 8.

"Here are 36 signs, which take three minutes in the transmission from New York to New Orleans, and which informs the New York merchant's correspondent at New Orleans of the receipt of a certain document, and gives him orders to purchase 25 bales of cotton, at 9 cents per pound, and 300 barrels of pork, at 8 cents per pound. Thus may be completed, in three minutes, a transaction in business which now would take at least four or five weeks to accomplish.

"Suppose that one cent per sign be charged for the first 100 miles, increasing the charge at the rate of half a cent each additional 100 miles; the postage of the above communication would be $2 88 for a distance of 1,500 miles. It would be sent 100 miles for 36 cents. Would any merchant grudge so small a sum for sending such an amount of information in so short a time to such a distance? If time is money, and to save time is to save money, surely such an immense saving of time is the saving of an immense sum of money. A telegraphic line of a single circuit only, from New York to New Orleans, would realize, then, to the government, *daily*, in the correspondence between those two cities alone, over *one thousand dollars* gross receipts, or over $300,000 per annum."

Since the above was written, in 1842, experience has shown that this calculation is far below the real results. Instead of *twelve signs* in a minute, upon which the above computation was based, we must substitute *thirty*—a column of a newspaper having been transmitted to Baltimore even at the rate of *thirty-five* signs in a minute. It is therefore safe to set down the rate at 30 signs per minute; and it is safe to double the annual receipts, making the gross amount $600,000 per annum.

In the absence of experience, the expense necessary to construct and to maintain a system of electro-magnetic telegraphs, was thought to be so great as to present a formidable, if not an insurmountable obstacle to its adoption. But the experiment already made for 40 miles, has shown that the electro-magnetic telegraph is far from being expensive, either in its first construction, or after maintenance, especially when its vast superiority over the old system is taken into consideration.

To make this more clear, I give an abstract both of the expenses and capacities of the ordinary visual telegraphs in some of the European countries.

In England, the semaphore telegraph established between London and Portsmouth, a distance of 72 miles, is maintained by the British government at an average expense of £3,405, or $15,118 per annum. From a return [vol. 30, 1843, accounts and papers of House of Commons] of the number of days during which the telegraph was *not available*, on account

of the weather, during a period of three years, it appears that there were in that time 323 days in which it was useless, or nearly *one year out of three!* But by a return made to the admiralty of the number of hours in the day appointed for working the telegraph, it appears that the hours appointed for the year are—from 1st October to 28th February, from 10 o'clock, a. m., to 3 p. m.; 5 hours. From 1st March to 30th September, from 10 a. m., to 5 p. m.; 7 hours.

Average number of hours per day, in the most favorable weather, 6 hours!

Deducting 1 year from the 3, for unavailable days, the average time per day for the 3 years would be but 4 hours. So that, for the use of their telegraph for 72 miles, and for only 4 hours in the day, the British government expend $15,118 per annum.

The French system of telegraphs is more extensive and perfect than that of any other nation. It consists, at present, of five great lines, extending from the capital to the extreme cities of the kingdom, to wit:

The Calais line, from Paris to Calais - - -	152	miles
The Strasbourg line, from Paris to Strasbourg - -	255	"
The Brest line, from Paris to Brest - - -	325	"
The Toulon line, from Paris to Toulon - - -	317	"
The Bayonne line, from Paris to Bayonne - - -	425	"
	1,474	miles.

Making a total of 1,474 miles of telegraphic intercourse. These telegraphs are maintained by the French government at an annual expense of over 1,000,000 of francs, or $202,000. (For the details of the expenditure of this sum, see B in appendix.)

The whole extent, then, of the French lines of telegraph is 1,474 miles, with 519 stations; and (if the estimate for six stations, at an average cost of 4,400 francs, is a criterion for the rest) erected at a cost of at least $880 each—making a total of $456,720.

The electro-magnetic telegraph, at the rate proposed in the bill, to wit, $461 per mile, (and which, it should be remembered, will construct not *one* line only, but *six*,) could be constructed the same distance for $619,514—not one-third more than the cost of the French telegraphs. Even supposing each line to be only as efficient as the French telegraph, still there would be six times the facilities, for not one third more cost. But when it is considered that the French telegraph, like the English, is unavailable the greater part of the time, the advantages in favor of the magnetic telegraph become more obvious.

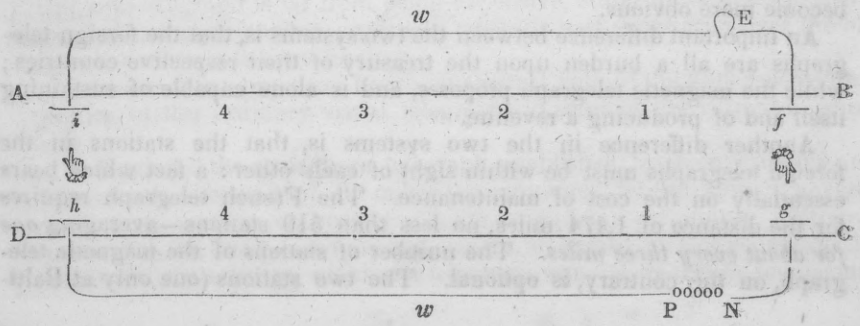
An important difference between the two systems is, that the foreign telegraphs are all a burden upon the treasury of their respective countries; while the magnetic telegraph proposes, and is alone capable of sustaining itself and of producing a revenue.

Another difference in the two systems is, that the stations in the foreign telegraphs must be within sight of each other: a fact which bears essentially on the cost of maintenance. The French telegraph requires for the distance of 1,474 miles, no less than 519 stations—averaging *one for about every three miles.* The number of stations of the magnetic telegraph, on the contrary, is optional. The two stations (one only at Balti-

more, and one at Washington) show that they may be at least 40 miles apart; and there is no reason to doubt, from experiments I have made, that 100 miles, or even 500 miles, would give the same results. In the maintenance, therefore, of stations, the magnetic telegraph would require but 15 stations, (assuming that 100 miles is the *utmost limit* of transmission between two stations, which is not probable;) while the French requires 519 for the same distance.

When to this are added the facts that the magnetic telegraph is at *all times available*, at *every hour of the day or night*, *irrespective of weather*; that, in comparison with the visual telegraphs, it communicates *more than a hundred fold* the quantity of intelligence in the same time; that it is originally constructed at a *less cost*, *(all things considered;)* that it is *maintained for less;* and that it is capable, by a rate of charges for transmitting intelligence, not only of defraying all its expenses, but, if desired, of producing a revenue, I may be permitted to hope that when these great advantages are fully understood, my system will receive that attention from the government which its intrinsic public importance demands.

At the close of the last session of Congress, there remained a surplus of about $3,500 unexpended of the appropriation of March 3, 1843, which has sufficed, by the exercise of a rigid economy, to defray the expenses thus far of sustaining the line in operation from Baltimore to Washington, and has also enabled me, among other experiments, to test the practicability of dispensing with the use of wires in crossing rivers—an experiment of much scientific, if not of practical interest. In the autumn of 1842, at the request of the American Institute, I undertook to give to the public in New York a demonstration of the practicability of my telegraph, by connecting Governor's island with Castle Garden, a distance of a mile; and for this purpose I laid my wires properly insulated beneath the water. I had scarcely begun to operate, and had received but two or three characters, when my intentions were frustrated by the accidental destruction of a part of my conductors by a vessel, which drew them up on her anchor, and cut them off. In the moments of mortification, in a sleepless night, I devised a plan for avoiding such an accident in future, by so arranging my wires along the banks of the river as to cause the water itself to conduct the electricity across. The experiment, however, was deferred till I arrived in Washington; and on December 16, 1842, I tested my arrangement across the canal, and with success. The simple fact was then ascertained, that electricity could be made to cross a river without other conductors than the water itself; but it was not until the last autumn that I had the leisure to make a series of experiments to ascertain the law of its passage. The following diagram will serve to explain the experiment.



A, B, C, D, are the banks of the river; N, P, are the battery; E is the electro magnet; *w*, *w*, are the wires along the banks, connecting with copper plates, *f*, *g*, *h*, *i*, which are placed in the water. When this arrangement is complete, the electricity generated by the battery passes from the positive pole P to the plate *h*, across the river through the water to plate *i*, and thence around the coil of the magnet E to plate *f*, across the river again to plate *g*, and thence to the other pole of the battery, N. The numbers 1, 2, 3, 4, indicate the distance along the bank measured by the number of times of the distance across the river.

The distance across the canal is 80 feet; on August 24th the following were the results of the experiment.

No. of the experiment - -	1st	2d	3d	4th	5th	6th
No. of cups in battery -	14	14	14	7	7	7
Length of conductors, *w*, *w* -	400	400	400	400	300	200
Degrees of motion of galvanometer -	32 & 24	13½ & 4½	1 & 1	24 & 13	29 & 21	21½ & 15
Size of the copper plates, *f*, *g*, *h*, *i* - -	5 by 2½ ft.	16 by 13 in.	6 by 5 in.	5 by 2½ ft.	5 by 2½ ft.	5 by 2½ ft.

Showing that electricity crosses the river, and *in quantity in proportion to the size of the plates in the water.* The *distance of the plates on the same side* of the river *from each other* also affects the result. Having ascertained the general fact, I was desirous of discovering the best practical distance at which to place my copper plates, and not having the leisure myself, I requested my friend Professor Gale to make the experiments for me. I subjoin his letter and the results.

NEW YORK, *November* 5, 1844.

MY DEAR SIR: I send you, herewith, a copy of a series of results, obtained with four different sized plates, as conductors to be used in crossing rivers. The batteries used were six cups of your smallest size, and one liquor used for the same throughout. I made several other series of experiments, but these I most rely on for uniformity and accuracy. You will see, from inspecting the table, that the distance along the shores should be *three times greater* than that from shore to shore across the stream; at least, that four times the distance does not give any increase of power. I intend to repeat all these experiments under more favorable circumstances, and will communicate to you the results.

Very respectfully,

L. D. GALE.

Professor S. F. B. MORSE,
Superintendent of Telegraphs.

Series of experiments on four different sizes of plates, to wit: 1st, 56 square inches; 2d, 28 square inches; 3d, 14 square inches; and 4th, 7 square inches.

Experiment 1st.—Surface of one face of the copper plate, 56 square inches; battery, Morse's smallest, 6 cups.

NOTE.—In all the experiments, *f* and *g* are stationary.

Distance from bank to bank.	Distance along shore.	1st Trial.	2d Trial.	3d Trial.	4th Trial.	5th Trial.	6th Trial.
1	1	22°	23°	23°	22°	22°	22°
1	2	31	32	31½	31	31	31
1	3	36	36	35½	35	35	35
1	4	36 scant	36 scant	34½	34	34	34

Experiment 2d.—Plates 28 square inches, conducted as above.

Distance from bank to bank.	Distance along shore.	1st Trial.	2d Trial.	3d Trial.	4th Trial.	5th Trial.	6th Trial.
1	1	18°	17°	17°	17°	17°	17°
1	2	27	26	27½	27½	27½	27
1	3	31	31	31	31	31	31
1	4	31	31	31	31	31 scant	31

Experiment 3d.—Plates 14 square inches, conducted as No. 1.

Distance from bank to bank.	Distance along shore.	1st Trial.	2d Trial.	3d Trial.	4th Trial.	5th Trial.	6th Trial.
1	1	8°	8½°	8½°	8°	8°	8°
1	2	19½	20	19½	19	19	19
1	3	23½	23½	23½	23½	23½	23½
1	4	24½	24½	23½	23½	23½	23½

Experiment 4th.—Plates 7 square inches, conducted as No. 1.

Distance from bank to bank.	Distance along shore.	1st Trial.	2d Trial.	3d Trial.	4th Trial.	5th Trial.	6th Trial.
1	1	5°	5°	5°	5°	3°	3°
1	2	15	14½	14	15	15	12
1	3	17½	18	17½	17½	18	17
1	4	18	18	18	17½	17½	17

The distance from bank to bank, 30 inches. Depth of water, 12 inches. In experiment 4, the liquor of the batteries was very weak, exhausted towards the last; and in trials 5 and 6, the irregularities are to be attributed in part to the weak liquor, and in part to the twilight hour at which the experiments were made.

As the result of these experiments, it would seem that there may be situations in which the arrangements I have made for passing electricity across the rivers may be useful, although experience alone can determine whether lofty spars, on which the wires may be suspended, erected in the rivers, may not be deemed the most practical. The experiments made were but for a short distance; in which, however, the principle was fully proved to be correct. It has been applied under the direction of my able assistants, Messrs. Vail and Rogers, across the Susquehanna river, at Havre-de Grace, with complete success—a distance of nearly a mile.

I have as yet said nothing on the telegraph as a mighty aid to national defence. Its importance in this respect is so obvious, that I need not dilate. The importance generally, to the government and to the country, of a *perfect* telegraphic system, can scarcely be estimated by the short distance already established between Baltimore and Washington. But when all that transpires of public interest at New Orleans, at St. Louis, at Pittsburg, at Cincinnati, at Buffalo, at Utica, at Albany, at Portland, at Portsmouth, at Boston, at New York, at Philadelphia, at Baltimore, at Washington, at Norfolk, at Richmond, at Charleston, at Savannah, and at all desired intermediate points, shall be *simultaneously* known in each and all these places together,—when all the agents of the government, in every part of the country, are in instantaneous communication with headquarters,—when the several departments can at once learn the actual existing condition of their remotest agencies, and transmit at the moment their necessary orders to meet any exigency,—then will some estimate be formed both of the powers and advantages of the magnetic telegraph.

Should the government be now disposed to possess the right of the proprietors, by giving them a fair consideration, I shall be ready to treat with them on the terms of transfer.

For myself, I should prefer that the government should possess the invention, although the pecuniary interests of the proprietors induce them to lean towards arrangements with private companies.

In closing this report, I would take the opportunity of favorably mentioning to the department the efficient attention to the duties of their respective stations given by my assistants, Alfred Vail and H. J. Rogers, esqrs.—the former directing the correspondence at the Washington terminus, and the latter at the Baltimore terminus.

Very respectfully, sir, your obedient servant,

SAM. F. B. MORSE,
Superintendent of Electro-magnetic Telegraphs for the United States.

To the Hon. Geo. M. Bibb,
Secretary of the Treasury.

APPENDIX.

A.

NEW YORK CITY UNIVERSITY,
September 27, 1837.

DEAR SIR: In reply to the inquiries which you have done me the honor to make, in asking my opinion "of the propriety of establishing a system of telegraphs for the United States," I would say, in regard to the general question, that I believe there can scarcely be two opinions, in such a community as ours, in regard to the advantage which would result, both to the government and the public generally, from the establishment of a system of communication by which the most speedy intercourse may be had between the most distant parts of the country. The *mail system*, it seems to me, is founded on the universally admitted principle, that the greater the speed with which intelligence can be transmitted from point to point, the greater is the benefit derived to the whole community. The only question that remains, therefore, is, what system is best calculated, from its completeness and cheapness, to effect this desirable end?

With regard to telegraphs constructed on the ordinary principles, however perfected within the limits in which they are necessarily confined, the most perfect of them are liable to one insurmountable objection: *they are useless the greater part of the time.* In foggy weather, and ordinarily during the night, no intelligence can be transmitted. Even when they can transmit, much time is consumed in communicating but little, and that little not always precise.

Having invented an entirely new mode of telegraphic communication, which, so far as experiments have yet been made with it, promises results of almost marvellous character, I beg leave to present to the department a brief account of its chief characteristics.

About five years ago, on my voyage home from Europe, the electrical experiment of Franklin, upon a wire some four miles in length, was casually recalled to my mind in a conversation with one of the passengers; in which experiment it was ascertained that the electricity travelled through the whole circuit in a time not appreciable, but apparently instantaneous. *It immediately occurred to me, that, if the presence of electricity could be made* VISIBLE *in any desired part of this circuit, it would not be difficult to construct a* SYSTEM OF SIGNS, *by which intelligence could be instantaneously transmitted.* The thought thus conceived took strong hold of my mind in the leisure which the voyage afforded, and I planned a system of signs, and an apparatus to carry it into effect. I cast a species of type, which I had devised for this purpose, the first week after my arrival home; and although the rest of the machinery was planned, yet, from the pressure of unavoidable duties, I was compelled to postpone my experiments, and was not able to test the whole plan until within a few weeks. The result has realized my most sanguine expectations.

As I have contracted to have a complete apparatus made to demonstrate at Washington by the 1st of January, 1838, the practicability and superi-

ority of my mode of telegraphic communication by means of electro-magnetism, (an apparatus which I hope to have the pleasure of exhibiting to you,) I will confine myself, in this communication, to a statement of its peculiar advantages.

First. The *fullest and most precise information* can be almost instantaneously transmitted between any two or more points, between which a wire conductor is laid; that is to say, no other time is consumed than is necessary to write the intelligence to be conveyed, and to convert the words into the telegraphic numbers. The numbers are then transmitted nearly instantaneously, or (if I have been rightly informed in regard to some recent experiments in the velocity of electricity) *two hundred thousand miles in a second!* to any distance, where the numbers are immediately recognised, and reconverted into the words of the intelligence.

Second. The same full intelligence can be communicated *at any moment, irrespective of the time of day or night, or state of the weather.* This single point establishes its superiority to all other modes of telegraphic communication now known.

Third. The whole apparatus will occupy but *little space,* (scarcely six cubic feet, probably not more than four;) and it may therefore be placed, without inconvenience, in any house.

Fourth. The *record of intelligence is made in a permanent manner, and in such a form* that it can be at once bound up in *volumes* convenient for reference, if desired.

Fifth. Communications are secret to all but the persons for whom they are intended.

These are the chief advantages of the electro-magnetic telegraph over other kinds of telegraphs, and which must give it the preference, provided the expense and other circumstances are reasonably favorable.

The newness of the whole plan makes it not so easy to estimate the expense, but an *approach* to a correct estimate can be made.

The principal expense will be the first cost of the wire or metallic conductors, (consisting of four lengths,) and the securing them against injury. The cost of a single copper wire $\frac{1}{16}$ of an inch in diameter, (and it should not be of less dimensions,) for 400 miles, was recently estimated in Scotland to be about £1,000 sterling, including the solderings of the wire together; that is, about six dollars per mile for one wire, or twenty four dollars per mile for the four wires. I have recently contracted for twenty miles of copper wire, No. 18, at 40 cents per pound. Each pound, it is estimated, contains 93 feet, which gives a result coinciding with the Scotch estimate, if $1 60 per mile be added for solderings.

The preparation of the wire for being laid, (if in the ground,) comprehends the *clothing of the wires* with an insulating or non-conducting substance; the *encasing them in wood, clay, stone, iron,* or *other metal;* and the *trenching* of the earth to receive them. In this part of the business I have no experience to guide me, the whole being altogether new. I can, therefore, only make at present a rough estimate. Iron tubes enclosing the wires, and filled in with pitch and resin, would probably be the most eligible mode of securing the conductors from injury, while at the same time it would be the most costly. Iron tubes of one and a half inch diameter, I learn, can be obtained at Baltimore at 28 cents per foot. The *trenching* will not be more than 3 cents for 2 feet, or about $75 per mile. This estimate is for a trench 3 feet deep and $1\frac{1}{2}$ foot wide. There

is no *grading;* the trench may follow the track of any road, over the highest hills or lowest valleys. Across rivers with bridges, the circuit may easily be carried enclosed beneath the bridge. Where the stream is wide, and no bridge, the circuit, enclosed in lead, may be sunk to the bottom.

If the circuit is laid through the air, the first cost would doubtless be much lessened. This plan of making the circuit has some advantages, but there are also some disadvantages; the chief of which latter is, that, being always in sight, the temptation to injure the circuit, to mischievously disposed persons, is greater than if it were buried out of sight beneath their feet. As an offset, however, to this, an injury to the circuit is more easily detected. With regard to danger from wantonness, it may be sufficient to say, that the same objection was originally made in the several cases, successively, of water pipes, gas-pipes, and railroads; and yet we do not hear of wantonness injuring any of these. Stout spars, of some 30 feet in height, well planted in the ground, and placed about 350 feet apart, would, in this case, be required, along the tops of which the circuit might be stretched. Fifteen such spars would be wanted to a mile. This mode would be as cheap, probably, as any other, unless the laying of the circuit in water should be found to be most eligible. A series of experiments to ascertain the practicability of this mode, I am about to commence with Professor Gale of our university, a gentleman of great science, and to whose assistance, in many of my late experiments, I am greatly indebted. We are preparing a circuit of twenty miles. The result of our experiments I will have the honor of reporting to you.

The other machinery, consisting of the apparatus for transmitting and receiving the intelligence, can be made at a very trifling cost. The only parts of the apparatus that waste or consume materials, are the batteries, which consume *acid* and *zinc;* and the register, which consumes *paper* for recording, and *pencils* or *ink* for marking.

The cost of *printing*, in the first instance, *of a telegraphic dictionary*, should perhaps also be taken into the account, as each officer of the government, as well as many others, would require a copy, should this mode of telegraphic communication go into effect. This dictionary would contain a full vocabulary of all the words in common use in the English language, with the numbers regularly affixed to each word.

The stations in the case of this telegraph may be as numerous as are desired; the only additional expense for that purpose being the adding of the transmitting and receiving apparatus to each station.

The cost of supporting a system of telegraphs on this plan (when a circuit is once established) would, in my opinion, be much less than on the common plans; yet, for want of experience in this mode, I would not affirm it positively.

As to "the propriety of connecting the system of telegraphs with any existing department of government," it would seem most natural to connect a telegraphic system with the Post Office Department; for, although it does not carry a mail, yet it is another mode of accomplishing the principal object for which the mail is established, to wit: the rapid and regular transmission of intelligence. If my system of telegraphs should be established, it is evident that the telegraph would have but little rest day or night. The advantage of communicating intelligence instantaneously in hundreds of instances of daily occurrence, would warrant such a rate of *postage* (if it may be so called) as would amply defray all expenses of the

first cost of establishing the system, and of guarding it, and keeping it in repair.

As every word is numbered, an obvious mode of rating might be a *charge of a certain amount on so many numbers.* I presume that five words can certainly be transmitted in a minute; for, with the imperfect machinery I now use, I have recorded at that rate at the distance of half a mile.

In conclusion, I would say, that if the perfecting of this new system of telegraphs (which may be justly called the American telegraph, since I can establish my claims to priority in the invention) shall be thought of public utility, and worthy the attention of government, I shall be ready to make any sacrifice of personal service and of time to aid in its accomplishment.

In the mean time, I remain, sir, with sincere respect, and high personal esteem, your most obedient humble servant,

SAML. F. B. MORSE.

Hon. LEVI WOODBURY,
Secretary of the Treasury.

B.

Expenses of the French telegraphs.

[Ministère de Finances, Budget de 1843, page 367—Congress law library.]

	Francs.
Salaries of persons engaged in the service in 1843	930,512
Expenses of materials	133,000
Total	1,063,512

Salaries of persons in service.

CENTRAL ADMINISTRATION AT PARIS.

1 administrator in chief	12,000
1 first assistant	8,000
1 second assistant	7,000
Total	27,000

Bureau de personnel.

1 chief of bureau	4,000
1 despatch master, (*expeditionnaire*)	1,800
1 second despatch master	1,500
Total	7,300

Accountability of funds.

	Francs.
1 chief of bureau, accountable agent	5,500
1 principal deputy	2,400
1 first despatch master	1,800
1 second despatch master	1,500
1 third despatch master	1,200
Total	12,400

Bureau of materials.

1 chief	4,000
1 magazine guard	1,800
Total	5,800

Cabinet of despatches.

1 translator in chief	6,000
1 assistant translator	5,000
1 first secretary	3,000
1 second secretary	2,400
Total	16,400

Messengers.

2 boys, at 800 francs each	1,600
1 keeper	900
Total	2,500

Exterior service.

THE CALAIS LINE.

This line is composed of 44 stations, divided into 4 divisions.

	Francs.
3 directors—	
1 at Boulogne	5,000.00
2 at Lille and Calais, at 4,500 francs each	9,000.00
4 inspectors, at 2,400 francs each	9,600.00
91 station keepers—	
19 of first class, at 2.25 francs each per day; or 821.25 per annum	15,603.75
6 of second class, at 1.75 franc each per day; or 638.75 per annum	3,832.50
66 of third class, at 1.50 franc each per day; or 547.50 per annum	36,135.00
Total	79,171.25

THE STRASBOURG LINE.

This line is composed of 49 stations, divided into 4 divisions.

	Francs.
2 directors—	
1 at Strasbourg	5,500.00
1 at Metz	4,500.00
4 inspectors—	
2 of first class, at 3,000 francs each	6,000.00
2 of third class, at 2,400 francs each	4,800.00
99 station keepers—	
17 of first class, at 2.25 francs each per day; or 821.25 per annum	13,961.25
6 of second class, at 1.75 franc each per day; or 638.75 per annum	3,832.50
76 of third class, at 1.50 franc each per day; or 547.50 per annum	41,610.00
Total	80,203.75

THE BREST LINE.

This line is composed of 107 stations, divided into 7 divisions.

5 directors—	
1 at Brest	5,500.00
2 at Nantes and Rennes, at 5,000 francs each	10,000.00
2 at Avranches and Cherbourg, at 4,500 francs each	9,000.00
7 inspectors—	
1 of first class	3,000.00
3 of second class, at 2,700 francs each	8,100.00
3 of third class, at 2,400 francs each	7,200.00
214 station keepers—	
32 of first class, at 2.25 francs each per day; or 821.25 per annum	26,280.00
18 of second class, at 1.75 franc each per day; or 638.75 per annum	11,497.50
164 of third class, at 1.50 franc each per day; or 547.50 per annum	89,790.00
Total	170,367.50

THE TOULON LINE.

This line is composed of 151 stations, divided into 11 divisions.

8 directors—	
1 of first class, at Toulon	5,500.00
3 of second class, at Marseilles, Lyons, and Besançon, at 5,000 francs each	15,000.00
4 of third class, at Dijon, Avignon, Nîmes, and Montpelier, at 4,500 francs each	18,000.00

	Francs.
11 inspectors—	
3 of first class, at 3,000 francs each	9,000 00
4 of second class, at 2,700 francs each	10,800.00
4 of third class, at 2,400 francs each	9,600.00
302 station keepers—	
50 of first class, at 2.25 francs each per day; or 821.25 per annum	41,062.50
34 of second class, at 1.75 franc each per day; or 638.75 per annum	21,717.50
218 of third class, at 1.50 franc each per day; or 547.50 per annum	119,355.00
Total	250,035.00

THE BAYONNE LINE.

This line is composed of 168 stations, divided into 11 divisions.

6 directors—	
1 of first class, at Perpignan	5,500.00
2 of second class, at Tours and Bayonne, at 5,000 francs each	10,000.00
3 of third class, at Bordeaux, Toulouse, and Narbonne, at 4,500 francs each	13,500.00
11 inspectors—	
2 of first class, at 3,000 francs each	6,000.00
5 of second class, at 2,700 francs each	13,500.00
4 of third class, at 2,400 francs each	9,600.00
336 station keepers—	
44 of first class, at 2.25 francs each per day; or 821.25 per annum	36,135.00
24 of second class, at 1.75 franc each per day; or 638.75 per annum	15,330.00
268 of third class, at 1.50 franc each per day; or 547.50 per annum	146,730.00
Total	256,295.00
Supplemental pay (*supplément de traitement*) to the 2 inspectors charged with the instruction of pupils, inspectors and station keepers, and to co-operate in the examination of the material	1,200.00
Assistance to disbanded station keepers, on account of infirmities or too great age after service of 20 or 30 years	2,181.00

Occasional expenses of persons.

Expense of general inspection	2,000.00
Temporary appointments, expense of vacations, and travelling and replacing of directors, inspectors, and station keepers taken ill—bed ridden	2,440.25
Charges (*haute paye*) of three horsemen, at 25 centimes; and 1 brigadier, at 50 centimes per day	456.25
Total	8,277.50

RECAPITULATION.

	Francs.
3 administrators - - - - - 27,000	
14 chiefs and employees—central administration 41,900	- 71,400.00
3 messengers - - - - - 2,500	

Directors.	Inspectors.	Station-keepers.	*Personal expenses of those in exterior service.*	
3	4	91	Line of Calais - - -	79,171.25
2	4	99	Line of Strasbourg - - -	80,203.75
5	7	214	Line of Brest - - -	170,367.50
8	11	302	Line of Toulon - - -	250,035.00
6	11	336	Line of Bayonne - - -	256,295.00
24	37	1,042		

Inspectors' instructors - - - - - -	1,200.00
Assistance to disbanded station-keepers - - -	2,181.00
Occasional personal expenses - - - -	4,896.50
Total - - - - - -	915,750.00

Expenses of material.

Administrative charges - - - -	15,500.00	
Fuel for the administration and offices - -	4,000.00	
Supplies of the store-house (*magasin*) - -	32,500.00	
General expense - - - -	3,156.00	
		55,156.00

EXTERIOR SERVICE OF FIVE LINES.

Expense of bureau of directors and inspectors, and small (minus) expenses of station-keepers.

24 directors, at 36 francs each per annum, for expense of office - - - - -	864.00	
37 inspectors, at 24 francs each per annum, for expense of office - - - - -	888.00	
519 station-keepers, at 8 francs each per annum, for small expenses and oiling of machines -	4,152.00	
		5,904.00

FUEL.

		Francs.
24 directors, at 96 francs each	2,304.00	
7 stations, at 36 francs each	252.00	
1 station, at 30 francs	30.00	
511 stations, at 24 francs each	12,264.00	
		14,850.00

MAINTENANCE OF POSTS.

519 stations, at 110 francs each	57,090.00
Grand total	1,048,750.00
Or	$210,000 00